142-TYPE AMPLIFIERS

TESTS, ADJUSTMENTS AND REQUIREMENTS

1. GENERAL

1.01 This addendum to Issue 1 of Section 024-106-500 is issued to revise the method of testing the primary power line supply voltage and the adjustment of the primary taps on the power transformer T2.

2. TESTS AND ADJUSTMENTS

(A) Power Transformer Adjustment

Change Paragraphs 2.01, 2.02, and 2.03 to read:

2.01 Power transformer T2 is provided with taps to cover the ac power line voltage ranges of 105-115 volts and 115-125 volts. The nominal ac power line voltage of the office should be determined, and the proper terminals, or leads, of the primary winding of transformer T2, shown in Fig. 6, connected to terminals 21 and 22 of the amplifier. These connections should be made before connecting the power line supply to the amplifier.

2.02 In the current model of the 142-type amplifier, T2 is a KS-14255 transformer, on which the winding taps are brought out to terminal lugs. Connections to amplifier terminals 21 and 22 are made by means of straps. In earlier models of the 142-type amplifier, T2 is a KS-13821 transformer on which the winding taps are brought out as flexible leads. In this case the proper flexible leads are terminated directly on terminals 21 and 22.

	Taps on T2	
	Terminals on	Leads on
AC Voltage	KS-14255	KS-13821
105-115	1 and 2	Black and Black-Yellow
115-125	1 and 3	Black and Black-Red

Copyright, 1954, by American Telephone and Telegraph Company
Printed in U. S. A.

142-TYPE AMPLIFIERS

TESTS, ADJUSTMENTS AND REQUIREMENTS

CONTENTS PAGE

1. GENERAL 1

2. TESTS AND ADJUSTMENTS 1

(A) Primary Power Voltage Measurement and Adjustment 1

(B) Electron Tube Tests 2

(C) Gain and Gain-Frequency Tests 2

(D) Noise Tests 3

(E) Preliminary Trouble Locating Tests.. 4

(F) Operating Voltage Measurements 4

(G) Electrolytic Capacitor Testing and Replacement 6

1. GENERAL

1.01 This section describes the tests, adjustments and requirements associated with 142-type amplifiers. It includes routine maintenance and trouble investigation tests. Inoluded also are schematic circuit diagrams indicating various voltage and current measurements, and wiring diagrams.

1.02 This section covers the standard 142-type amplifiers, coded 142A, 142B, 142C and 142D which are described in Section 024-106-100. This section also may be used insofar as it applies to variations of the 142A amplifier, some of which are described in Section 024-106-101.

1.03 Section 024-106-300 lists the initial and routine tests, as well as information on the frequency of routine maintenance tests, on 142-type amplifiers.

1.04 Lists of parts for the standard 142-type amplifiers, as well as for some variations of the 142A amplifier, are included in Sections 024-106-100 and 024-106-101, respectively.

1.05 Test Equipment: The tests throughout this section require the use of the following test equipment:

1 - KS-14510 Volt - Ohm - Milliammeter, Weston 779A Analyzer or equivalent

1 - KS-15560-L1 Tube Tester or equivalent

1 - 19C Oscillator or equivalent

1 - 13A Transmission Measuring Set or equivalent

1 - 5A Attenuator

1 - Output Pad as desoribed in Paragraph 2.09

1 - 2B Noise Measuring Set

The miscellaneous items necessary for the following tests are shielded connecting cords and a 600-ohm resistor suitable for test terminations.

2. TESTS AND ADJUSTMENTS

(A) Primary Power Voltage Measurement and Adjustment

2.01 The purpose of this test is to determine which taps on the primary winding of the power transformer T2 in the amplifier are to be connected to the a-c supply. Information is also included for the earlier amplifier models employing KS-13821 power transformers. (Refer also to Paragraph 2.18.)

2.02 Apparatus:

KS-14510 Volt-Ohm-Milliammeter

2.03 Procedure:

(1) Adjust the voltmeter for an a-c reading of over 100 volts.

(2) Measure the a-c supply voltage at the fuse box or other convenient point between the fuse box and the amplifier.

(3) Determine which terminals, or leads, of the primary winding of the amplifier power transformer, shown in Fig. 6, are connected to terminals 21 and 22 of the amplifier.

Required Strapping: The correct taps on the primary winding of the power transformer are determined as follows:

© American Telephone and Telegraph Company, 1953
Printed in U.S.A.

A-c Voltage	Taps on T2: Terminals on KS-14255	Taps on T2: Leads on KS-13821
105-115	1 and 2	Black and Black-Yellow
115-125	1 and 3	Black and Black-Red

Caution: In making these measurements care should be taken to avoid contact with line terminals.

(B) Electron Tube Tests

2.04 These tests will check the tubes for correct operation in the amplifier.

2.05 Apparatus:

1 - KS-15560-L1 Tube Tester

2.06 Procedure:

(1) Test each tube in accordance with the information given in Section 100-635-501.

(2) Discard any tubes which fail to meet the requirements.

Caution: When the amplifier is operating, the tubes will be too hot to handle safely. Use gloves or other suitable covering before removing a tube.

(C) Gain and Gain-Frequency Tests

General

2.07 Gain tests on 142-type amplifiers require great care due not only to high gains which may be encountered in some cases, but also to the fact that this type of amplifier is capable of much greater power output than those usually encountered in the telephone plant. The use of shielded connecting cords is specified. This should aid materially in avoiding errors due to stray coupling between input and output circuits when measuring high gains such as those on the 142B and 142D amplifiers. In all cases an attenuator should be employed between the source of testing power and the amplifier. A pad between the output of the amplifier and the transmission measuring set is also specified in order that the power handling capacity of the latter may not be exceeded.

2.08 In all cases the output level of the oscillator is 1 milliwatt at the test frequencies specified in Table 1. The oscillator and transmission measuring set are connected together, and the oscillator is adjusted until a reading of 0 dbm is obtained on the measuring set. Then the oscillator and measuring set are reconnected to provide the arrangement for each test to be described.

2.09 Fig. 1 shows a suggested arrangement of the output pad referred to in Paragraph 2.07. R1 is a 360-ohm resistor and must dissipate approximately 11 watts of power with the amplifier supplying full power output of 12 watts. It may be made up with six 60-ohm type 19NY resistors in series, or any 360-ohm, 25-watt resistor. R2 is a 43-ohm, 2 or 5-watt resistor. The loss of this pad will be approximately 22 db, the actual value depending upon the accuracy of the resistors used.

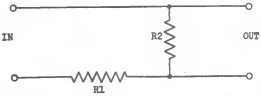


Fig. 1 - Suggested Output Pad Arrangement

2.10 The tests indicated in Table 1, on page 7, cover the input arrangements on all four models of the 142-type amplifier. This table also indicates the various gain requirements and allowable gain-frequency deviations.

2.11 The following equipment is required for making these tests:

1 - 19C Oscillator or equivalent

1 - 5A Attenuator or equivalent

1 - Output Pad as described in Paragraph 2.09

1 - 13A Transmission Measuring Set or equivalent

Shielded Connecting Cords for setting up the testing arrangements

2.12 Set up the testing arrangements indicated in Figs. 2 and 3, using the input terminals for the particular input arrangement of the amplifier under test. Fig. 2 shows the shielding and grounding employed in the arrangement for gain tests on the 142A amplifier. Fig. 3 shows the arrangement for testing the B, C and D models. Somewhat more shielding and grounding is employed in Fig. 3 because of the higher gains in these amplifiers, particularly in the 142B and 142D models. The gain of the amplifier is indicated by the algebraic sum of the attenuator loss, output pad loss and the dial and meter readings on the measuring set.

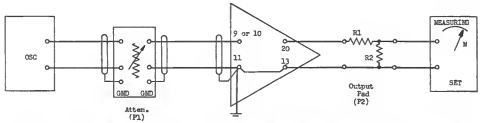


Fig. 2 - 142A Amplifier - Gain and Gain Frequency Testing Arrangement

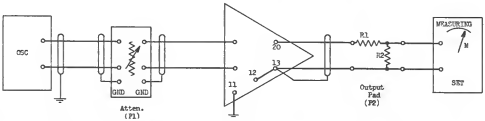


Fig. 3 - 142B, 142C, 142D Amplifier - Gain and Gain Frequency Testing Arrangement

(D) Noise Tests

2.13 These tests are made to determine the amount of noise produced by the amplifier at maximum gain.

2.14 Apparatus:

1 - 2B Noise Measuring Set

1 - Output Pad as described in Paragraph 2.09

1 - 600-ohm Terminating Resistor with Short Leads

Shielded Connecting Cords

2.15 Procedure:

(1) Calibrate the 2B noise measuring set in accordance with Section E40.459.1.

(2) Insert the input plug in the LINE jacks and dummy plugs in the SOUND and VOL jacks. Operate K3 to FLAT.

(3) Terminate the input of the amplifier under test and set the gain control(s) as indicated in Table 2.

(4) Set up one of the testing arrangements shown in Figs. 4 and 5, depending upon the amplifier model under test. Fig. 4 shows the connections for the 142A amplifier, and Fig. 5 shows the connections for the 142B, 142C and 142D amplifiers.

(5) Obtain the algebraic sum of the dial and meter readings of the noise set, the correction factors per Section E40.459.1, and the loss of the output protection pad.

Requirements: The noise limits indicated in Table 2 should not be exceeded.

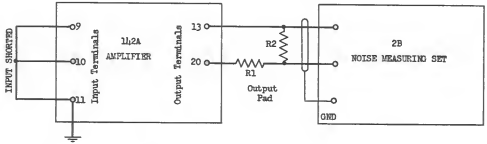


Fig. 4 - 142A Amplifier - Noise Measuring Arrangement

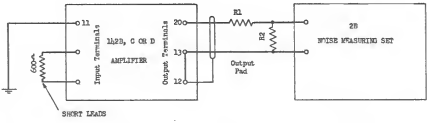


Fig. 5 - 142B, 142C, 142D Amplifier - Noise Measuring Arrangement

(E) Preliminary Trouble Locating Tests

2.16 When the amplifier is in trouble and the cause is not due to burned out or otherwise defective tubes, the amplifier should be checked (with a-c power switched off) for loose connections or broken wires. Fig. 8 shows a wiring diagram of the basic or 142A amplifier, and Fig. 9 shows a wiring diagram of the input circuit of the 142B amplifier. This is actually a diagram of the 141A preamplifier. Fig. 10 and Fig. 11 are block diagrams of the 142C and 142D amplifiers, respectively.

Caution: Avoid personal contact with terminals, especially those on electrolytic capacitors. The charge on some of these will be over 400 volts.

(F) Operating Voltage Measurements

2.17 If the tests mentioned above fail to reveal the trouble, it will be necessary to check the operating voltages in the amplifier. Figs. 6 and 7 show these voltages in the basic amplifier and 141A preamplifier, respectively. The values shown are typical of those which may be expected when employing a voltmeter with a resistance of at least 20,000 ohms per volt, and an a-c line voltage of 120 volts.

2.18 The values of voltages on the various elements of the electron tubes may be measured at the tube sockets on the underside of the chassis. The terminal on the socket to which each element of the electron tube is connected is indicated by terminal number on the schematic drawings in Figs. 6 and 7. The standard numbering sequence for tube sockets is shown in the wiring diagrams in Figs. 8 and 9.

2.19 Where the 142-type amplifier under test is an early production model employing a KS-13821 power transformer, the following table will be of aid by showing the relationship between the leads of this transformer and the terminals on T2 of Fig. 6.

Terminals on KS-14255(T2)	Lead Colors on KS-13821
1	Black
2	Black-Yellow
3	Black-Red
4	Red-Green
5	Red-Yellow
6	Red
7	Orange-Black
8	Orange
9	Yellow
10	Yellow
11	Green
12	Green-Yellow
13	Green

2.20 Apparatus:

KS-14510 Volt-Ohm-Milliammeter

2.21 Procedure:

(1) Switch on the a-c power supply and wait for several minutes.

(2) Obtain voltage readings, beginning at the output of the power rectifier tube, and working back through the circuit to the elements of the other tubes until an indication of the trouble location is obtained.

Caution: In making these tests, care should be taken to avoid contact with live terminals. It should be noted that normal operating voltages of over 400 volts may be encountered.

TABLE 2

Noise Tests and Requirements on 142-Type Amplifiers

Amplifiers (See Note 1)	Input Terminal Arrangements	Gain Control P1 on 142A Ampl.	D1 on 713B Unit	Gain Control on 141A Ampl.	Gain Control P1 on 713B Unit	Noise Limit (Using 2B Noise Measuring Set - Flat Weighting)
142A	Short and ground terminals 9, 10 and 11	Max.	-	-	-	60 dba
142B	Connect 600 ohms to terminals 1 and 3 and ground terminal 11	Max.	-	70 db	-	85 dba
142C	Connect 600 ohms to terminals 4 and 8 and ground terminal 11	Max.	-	-	-	60 dba
142D	Connect 600 ohms to terminals 1 and 3 and ground terminal 11	Max.	MIC	70 db	Max.	85 dba
142D	Connect 600 ohms to terminals 4 and 8 and ground terminal 11	Max.	LINE	-	-	60 dba

Note 1: Use 600-ohm output connection. (Terminals 13 and 20. Strap terminals 14 and 15, 16 and 17, 18 and 19.)

(G) Electrolytic Capacitor Testing and Replacement

2.22 It may be necessary to attempt to reform the film in the electrolytic capacitors in a 142-type amplifier if the latter has not been in use for several months. This may be done by following the method described in Section 032-110-701.

2.23 If the hum level of the amplifier is high after an attempt has been made to reform the capacitor film, the capacitors should be tested as described in Section 032-110-701, and replaced where the need is indicated.

TABLE 1

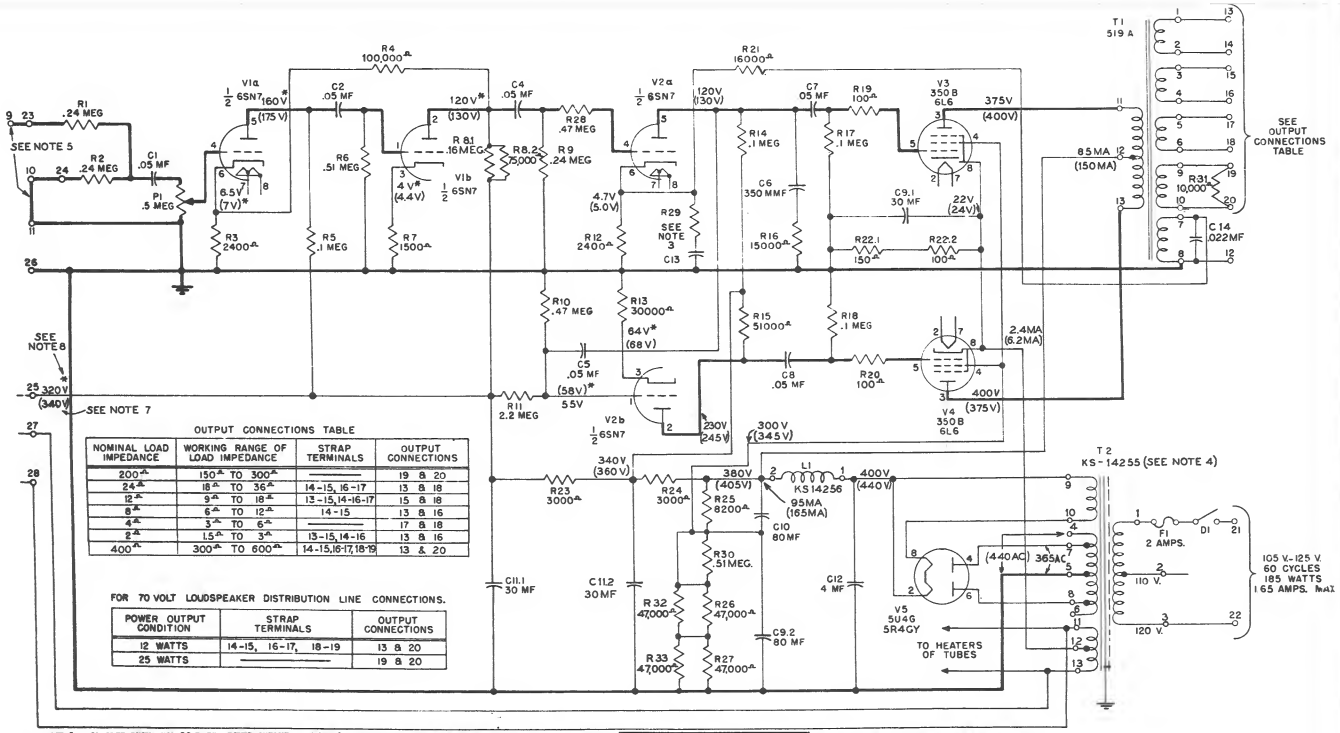
Gain and Gain-Frequency Tests and Requirements on 142-Type Amplifiers

Amplifiers and Test Frequencies See Note 1	Input Terminal Connections See Note 2	Gain Control* P1 on 142A Ampl.	Strap Terminals	D1 on 713B Unit	Gain Control* on 141A Ampl.	Gain Control* P1 on 713B Unit	Gain (G = Gain at 1000 Cycles)
142A							
1000 ~	9-11	Max.	10-11	-	-	-	G_A = 50 db ± 1.5 db
1000 ~	10-11	Max.	9-11	-	-	-	G_A = 50 db ± 1.5 db
50 ~	10-11	Max.	9-11	-	-	-	(G_A-0.4) db ± 0.5 db
15,000 ~	10-11	Max.	9-11	-	-	-	(G_A-0.5) db ± 0.5 db
142B							
1000 ~	1-3	Max.	-	-	70 db	-	G_B = 115 db ± 2.0 db
50 ~	1-3	Max.	-	-	70 db	-	(G_B-0.5) db ± 1.0 db
15,000 ~	1-3	Max.	-	-	70 db	-	G_B ± 1.5 db
1000 ~	1-3	Max.	-	-	60 db	-	(G_B-10) db ± 2.0 db
1000 ~	1-3	Max.	-	-	40 db	-	(G_B-30) db ± 3.0 db
142C							
1000 ~	4-8	Max.	6-7	-	-	-	G_C = 69 db ± 2.0 db
50 ~	4-8	Max.	6-7	-	-	-	(G_C-0.5) db ± 1.5 db
10,000 ~	4-8	Max.	6-7	-	-	-	(G_C+0.5) db ± 1.5 db
142D							
1000 ~	1-3	Max.	-	MIC	70 db	Max.	G_D = 115 db ± 2.0 db
50 ~	1-3	Max.	-	MIC	70 db	Max.	(G_D-0.5) db ± 1.0 db
15,000 ~	1-3	Max.	-	MIC	70 db	Max.	G_D ± 1.5 db
1000 ~	1-3	Max.	-	MIC	60 db	Max.	(G_D-10) db ± 2.0 db
1000 ~	1-3	Max.	-	MIC	50 db	Max.	(G_D-20) db ± 2.5 db
1000 ~	1-3	Max.	-	MIC	40 db	Max.	(G_D-30) db ± 3.0 db
1000 ~	4-8	Max.	-	LINE	-	-	G_D = 69 db ± 2.0 db
50 ~	4-8	Max.	-	LINE	-	-	(G_D-0.5) db ± 1.5 db
10,000 ~	4-8	Max.	-	LINE	-	-	(G_D+0.5) db ± 1.5 db

Note 1: Use 600-ohm output connections. (Terminals 13 and 20. Strap terminals 14 and 15, 16 and 17, 18 and 19).

Note 2: All inputs are 600 ohms.

*Note 3: Make a 1000~ attenuation test by observing that the gain gradually reduces from maximum to zero as the gain control is turned slowly from maximum to off.



OUTPUT CONNECTIONS TABLE

NOMINAL LOAD IMPEDANCE	WORKING RANGE OF LOAD IMPEDANCE	STRAP TERMINALS	OUTPUT CONNECTIONS
200Δ	150Δ TO 300Δ	———	19 & 20
24Δ	18Δ TO 36Δ	14-15, 16-17	13 & 18
12Δ	9Δ TO 18Δ	13-15, 14-16-17	15 & 18
8Δ	6Δ TO 12Δ	14-15	13 & 16
4Δ	3Δ TO 6Δ	———	17 & 18
2Δ	1.5Δ TO 3Δ	13-15, 14-16	13 & 16
400Δ	300Δ TO 600Δ	14-15, 16-17, 18-19	13 & 20

FOR 70 VOLT LOUDSPEAKER DISTRIBUTION LINE CONNECTIONS.

POWER OUTPUT CONDITION	STRAP TERMINALS	OUTPUT CONNECTIONS
12 WATTS	14-15, 16-17, 18-19	13 & 20
25 WATTS	———	19 & 20

NOTE 1: CIRCUIT SHOWN FOR 12 WATTS POWER OUTPUT.

NOTE 2: FOR 25 WATTS OUTPUT THE FOLLOWING CHANGES ARE NECESSARY:
(A) USE 350B TUBES.
(B) SHORT R22.2.
(C) AT TRANSFORMER T2 TRANSFER LEAD FROM TERMINAL 7 TO TERMINAL 4 AND LEAD FROM TERMINAL 8 TO TERMINAL 6.
(D) REMOVE SHORT ACROSS R30.

NOTE 3: THESE VALUES ARE DETERMINED AT THE FACTORY TO MEET GAIN-FREQUENCY REQUIREMENTS. R29 IS 820 OHMS OR GREATER AND C13 IS .01 MF OR LESS.

NOTE 4: REFER TO TEXT WHEN T2 IS KS-13821.

NOTE 5:

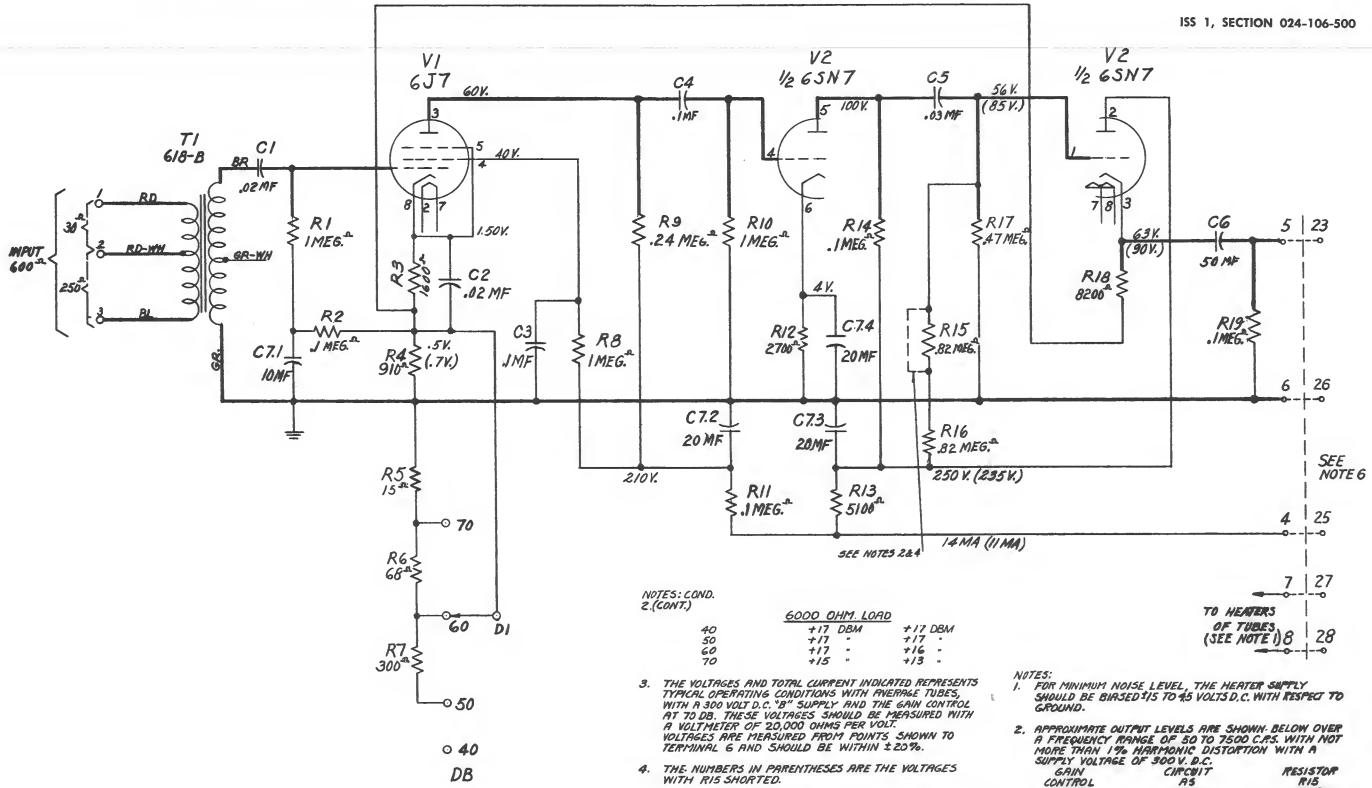
AMPLIFIER	REMOVE STRAP BETWEEN TERM.	STRAP TERMINALS
142B	9-23	10 TO 11
142C	-	10 TO 11
142D	-	10 TO 11

NOTE 6: THE VOLTAGES AND CURRENTS SHOWN REPRESENT TYPICAL VALUES FOR A QUIESCENT CONDITION WITH AVERAGE TUBES AND OPERATED FROM A 60-CYCLE, 120-VOLT POWER SOURCE. THE D-C VOLTAGE SHOULD BE MEASURED WITH A VOLTMETER OF 20,000 OHMS PER VOLT. VOLTAGES ARE MEASURED FROM POINTS SHOWN TO TERMINAL 26 AND SHOULD BE WITHIN ± 20%.

NOTE 7: THE NUMBERS IN PARENTHESES ARE THE VOLTAGES FOR THE 25 WATT CONDITION.

NOTE 8: THE ASTERISK APPLIES TO BOTH NUMBERS AND INDICATES THAT THESE VALUES WILL BE 80% OF THOSE SHOWN WHEN A 142B OR 142D AMPLIFIER CONNECTION IS USED.

Fig. 6 - 142A Amplifier Schematic



NOTES: COND.
2.(CONT.)

	6000 OHM LOAD	
40	+17 DBM	+17 DBM
50	+17 -	+17 -
60	+17 -	+16 -
70	+15 -	+13 -

3. THE VOLTAGES AND TOTAL CURRENT INDICATED REPRESENTS TYPICAL OPERATING CONDITIONS WITH AVERAGE TUBES, WITH A 300 VOLT D.C. "B" SUPPLY AND THE GAIN CONTROL AT 70 DB. THESE VOLTAGES SHOULD BE MEASURED WITH A VOLTMETER OF 20,000 OHMS PER VOLT. VOLTAGES ARE MEASURED FROM POINTS SHOWN TO TERMINAL 6 AND SHOULD BE WITHIN ±20%.

4. THE NUMBERS IN PARENTHESES ARE THE VOLTAGES WITH R15 SHORTED.

5. IN CASES WHEN THE "B" SUPPLY VOLTAGES IS OTHER THAN 300 VOLTS, THE VOLTAGES INDICATED ARE MULTIPLIED BY THE RATIO OF THAT VOLTAGE AND 300.

6. THESE TERMINALS ARE ON THE CHASSIS OF THE 142 A AMPLIFIER.

NOTES:

1. FOR MINIMUM NOISE LEVEL, THE HEATER SUPPLY SHOULD BE BIASED 7.5 TO 15 VOLTS D.C. WITH RESPECT TO GROUND.

2. APPROXIMATE OUTPUT LEVELS ARE SHOWN BELOW OVER A FREQUENCY RANGE OF 50 TO 7500 C.P.S. WITH NOT MORE THAN 1% HARMONIC DISTORTION WITH A SUPPLY VOLTAGE OF 300 V. D.C.

GAIN CONTROL SETTING	CIRCUIT AS SHOWN	RESISTOR R15 SHORTED
	600 OHM LOAD	
40	+11 DBM	+14 DBM
50	+11 -	+14 -
60	+10 -	+13 -
70	+6 -	+11 -

Fig. 7 - 142B Amplifier-Input Circuit Arrangement (141A Amplifier Schematic)

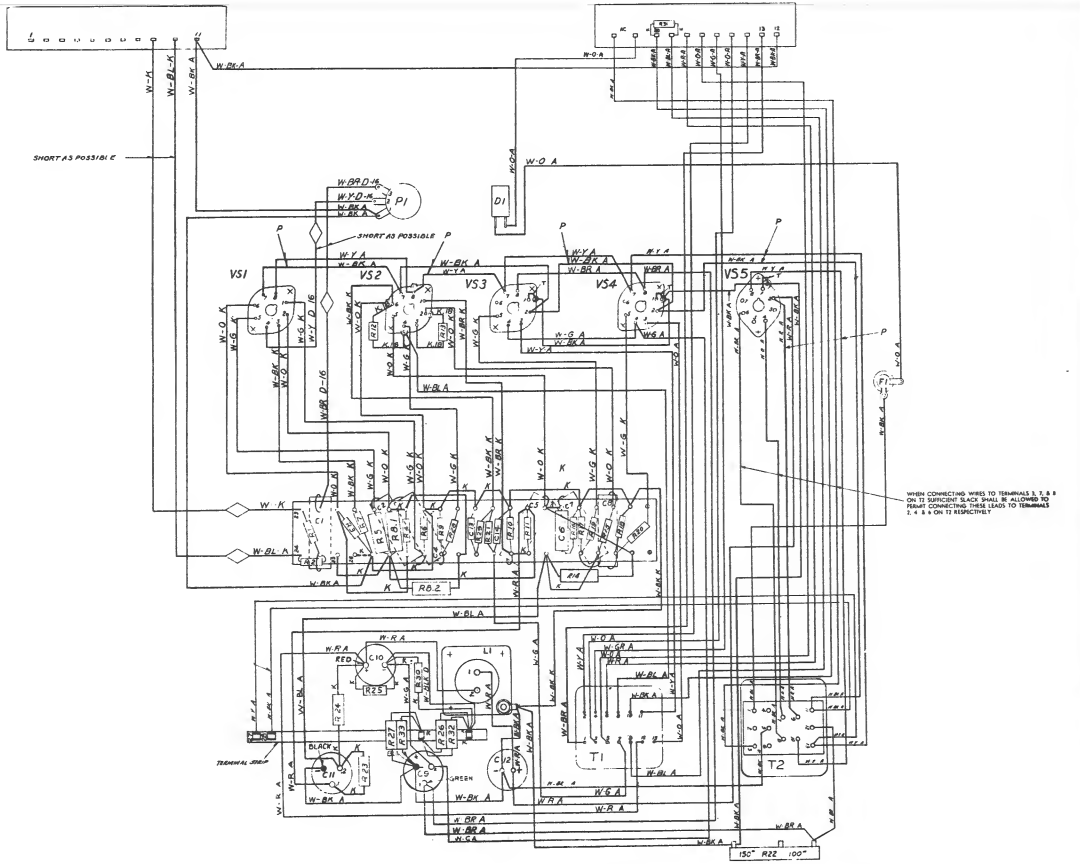


Fig. 8 - 142A Amplifier Wiring Diagram

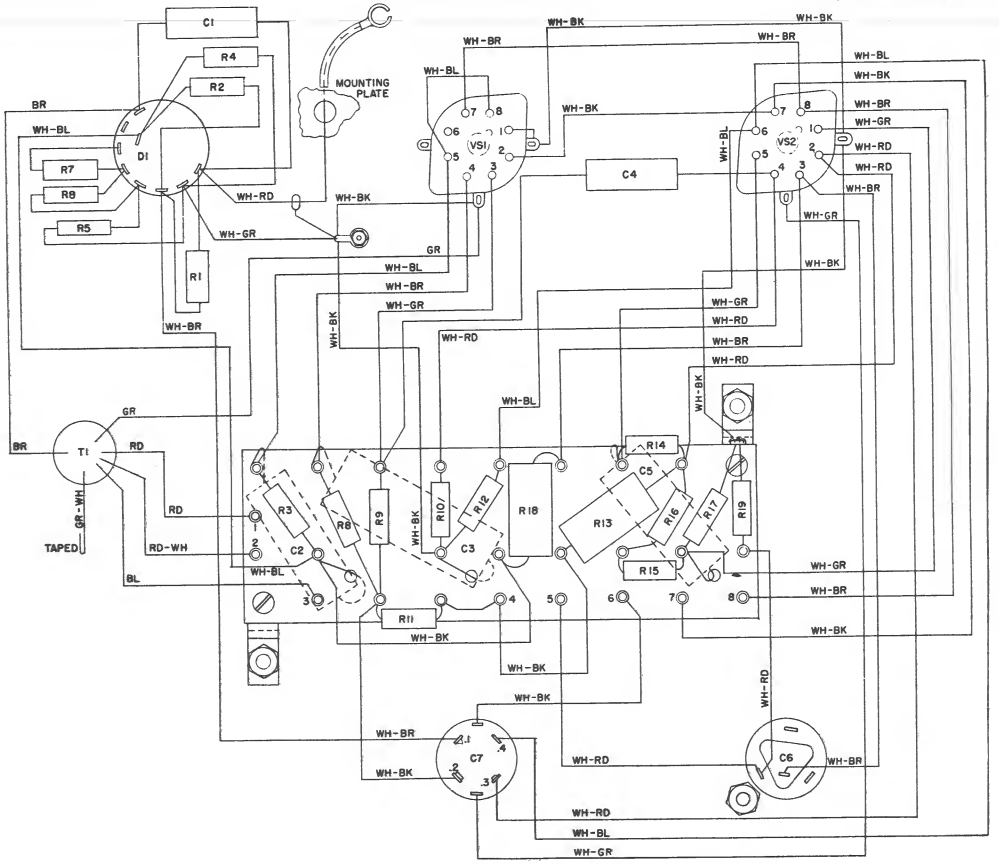


Fig. 9 - 141A Amplifier Wiring Diagram

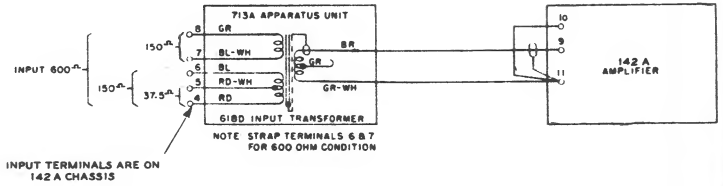


Fig. 10 - 142C Amplifier - Block Diagram

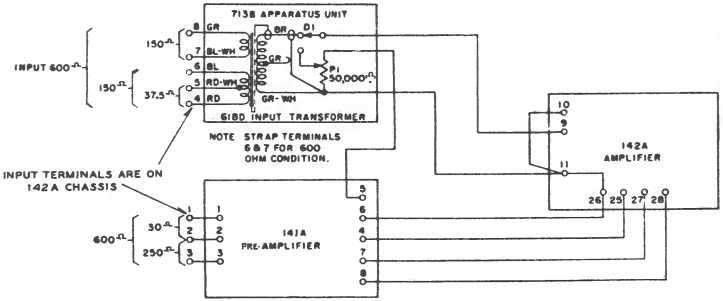


Fig. 11 - 142D Amplifier - Block Diagram